USAISEC

US Army Information System Engineering Command
Fort Huachuca, AZ 85613–5300

(2)

U.S. ARMY INSTITUTE FOR RESEARCH
IN MANAGEMENT INFORMATION,
COMMUNICATIONS, AND COMPUTER SCIENCES
(AIRMICS)

AD-A218 303

Applied Research and Technical Insertion as a Function of Systems Integration and Modernization in the U.S Army Information Systems Resource; Final Report

(ASQBG-A-89-039)

December,1988

AIRMICS
115 O'Keefe Bldg
Georgia Institute of Technology
Atlanta, GA 30332–0800

90 01 30 009

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704--188
Exp. Date: Jun 30, 1986

1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED	1b. RESTRICTIVE MARKINGS NONE
2a. SECURITY CLASSIFICATION AUTHORITY N/A	3. DISTRIBUTION / AVAILABILITY OF REPORT N/A
2b. DECLASSIFICATION / DOUWNGRADING SCHEDULE N/A	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) ASQBG-A-89-039	5. MONITORING ORGANIZATION REPORT NUMBER(S) N/A
6a. NAME OF PERFORMING ORGANIZATION AIRMICS 6b. OFFICE SYMBOL (if applicable) ASQBG - A	7a. NAME OF MONITORING ORGANIZATION N/A
6c. ADDRESS (City, State, and ZIP Code) 115 O'Keefe Bldg., Georgia Institute of Technology Atlanta, GA 30332-0800	7b. ADDRESS (City, State, and Zip Code) N/A
8a. NAME OF FUNDING/SPONSORING ORGANIZATION AIRMICS 8b. OFFICE SYMBOL (if applicable) ASQBG - A	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c. ADDRESS (City, State, and ZIP Code) 115 O'Keefe Bldg., Georgia Institute of Technology Atlanta, GA 30332-0800	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO.: 62783A PROJECT NO.: DY10 TASK NO.: 07 WORK UNIT ACCESSION NO.:

11. TITLE (Include Security Classification)

Applied Research and Technical Insertion as a Function of Systems Integration and Modernization in the U.S. Army Information Systems Resource: Final Report (UNCLASSIFIED)

12. PERSONAL AUTHOR(S)

G.J. Dunleavy

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
	FROM ______ TO ______	1988 December	21

16. SUPPLEMENTARY NOTATION

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	Information Systems Resource

19. ABSTRACT (Continue on reverse if necessary and identity by block number)

This final report discusses the factors in the insertion or transfer of technology and the relationship between the factors. The author provides implementation guidance for the insertion of technology.

20. DISTRIBUTION / AVAILABILITY OF ABSTRACT ☒ UNCLASSIFIED / UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS	21. ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED
22a. NAME OF RESPONSIBLE INDIVIDUAL Michael J. Evans	22b. TELEPHONE (Include Area Code) (404) 894-3107 22c OFFICE SYMBOL ASQBG - A

DD FORM 1473, 84 MAR

83 APR edition may be used until exhausted
All other editions are obsolete

SECURITY CLASSIFICATION OF THIS PAGE
UNCLASSIFIED

This research was sponsored by the Army Institute for Research in Management Information, Communications, and Computer Sciences (AIRMICS), the RDTE organization of the U.S. Army Information Systems Engineering Command (USAISEC). This final report discusses the factors in the insertion or transfer of technology and the relationship between the factors. This research report is not to be construed as an official Army position, unless so designated by other authorized documents. Material included herein is approved for public release, distribution unlimited. Not protected by copyright laws.

THIS REPORT HAS BEEN REVIEWED AND IS APPROVED

s/ James Gantt
James Gantt, Chief
Management Information
Systems Division

s/ John R. Mitchell
John R. Mitchell
Director
AIRMICS

Table of Contents

1. INTRODUCTION

The last three tasks under this contract identified the considerations and methodologies to be used in the review and evaluation of applications in operation today. The purpose of this application review process is to identify at what point in time it is possible, practical, and preferable to migrate an application from one level of operation to another. A parallel consideration is the issue of technology insertion during the redesign and rewrite phase of the migration effort. A determination must be made as to whether or not the technology insertion is cost effective in the short run as well as aligning the application with the long range goals of the functional proponent and to insure that the goals of the functional proponent are in concert with the overall **SYSTEM GOALS.**

1.1. GENERAL

Proponents, at the functional level and at other levels of the Army have, in the past, developed solutions for limited scope problems which resulted in stand-alone solutions otherwise known as "Stove-Pipe" systems. The "Stove-Pipe" systems have existed from prior to the Republic of Vietnam (RVN) conflict to today basically unchanged and they have served to satisfy a single commodity user's specific needs without regard to the need to share data between themselves and other systems. These systems were for the most part state-of-the-art at the time of conception or fielding and were supportive of the Army Maneuver Doctrine in effect when they were fielded.

Technological advancement in weapons systems and a major change in Maneuver Doctrine have created a new set of performance requirements which are beyond the capability of the majority of the "Stove-Pipe" systems.

Irrespective of the scenario one might chose to elect for the conduct of a future conflict, information, and the ability to analyze information in relation to situations has become increasingly important. It may well determine the outcome of the majority of future conflicts. The world has become smaller and more dangerous as a result of technological advances in destructive power of advanced weapons systems and the accuracy and speed of delivery of those weapons systems.

National defense is a global proposition in support of U.S. interests at home and abroad. The Army has a significant number of forces stationed throughout the world. Ultimately, those forces are where they are to protect and to shield the U.S. as well as to support our alliance partners. The costs associated with the maintenance of this posture and the relationship of our trade position with the rest of the world has also changed over time. The costs have risen by orders of magnitude and our trade position is the worst it has ever been. These and other factors are forcing the Army to do more and more with less and less resources.

Computerization, automation, and the application of electronic technology portends the major tools for accomplishing the increases in productivity, reliance and flexibility needed to meet the changes dictated by our position relative to the rest of the world and to meet the challenge of ever increasing technological capacity world-wide.

The Army Information Systems must be postured and optimized to support three levels of performance or three states.

- o Peace Time
- o Transition to War
- o War

1.2. PEACE TIME

The Peace Time phase, also frequently referred to as "go-to-work", can be characterized as a maintenance state during which we support the level of deployment and training necessary to keep the force poised to move through the transition state quickly and then smoothly into the war state. This is also a period of continuous evaluation and reevaluation of readiness and the effect of our strategy and plans to support transition and go-to-war.

If the force is kept in a steady state of preparedness and the deployed technology is sufficient to meet the threat structure then the amount of change required in the transition phase is low. If the force is permitted to degrade and the Army is forced to deploy with a capability which is below standard then we are at risk and the amount of transitional change including the associated cost in terms of life, property, and territory go up. It is important to note that there is very little that can be done in the time between the Peace-Time and War-Time phase to increase the probability of a better outcome in the early stages of engagement. The preparations which require long lead times must be accomplished prior to the beginning of the Transition phase. Otherwise, the real danger is that the outcome will be determined before the system is capable of adjusting to new directions or states.

1.3. TRANSITION TO WAR

The Transition phase can be characterized as short period of time between the Peace-Time state and the War state with its full scale engagements. During the Transition phase the major function is to set in place the resources necessary to counter the threat where it exists and to deploy other resources to counter other threats and to prepare to shift from a defensive to offensive posture. Intelligence evaluation is the capstone of the transition phase as is preplanning to move from a relatively static state to a circumstance where dynamic change in both the defense and private sector is pervasive. During the Peace-Time phase one might expect to encounter passive opposition. During the Transition phase the passive actions will likely be accompanied by active attempts to disrupt, confuse and destroy resources, transport, C4I.

The Transition phase, should we be fortunate enough to have the luxury of this interlude between Peace and War can be thought of as a time in which to prime our weapons. The same is true for the Information Systems Resources. Traffic will increase in the system as a result of heightened tensions, and the obvious need to update incident reports as well as delivery of status reports on preplanned actions. The volume of data which must transit the system in order to bring it to it's peak of preparedness is a function of preplanning and prepositioning. The less the better. This is a particularly good time for the Electronic Warfare (EW) analyst, and one must assume that the oppositions capacity to perform sophisticated EW analysis is excellent. The Information Systems Resources will be called upon to deliver close to peak efficiency during the transition phase. An additional peak could be expected to occur in the early phases of engagement and with the depletion of organic resources within the Combat Support and Combat Service Support elements.

If we assume an enemy first strike, the US forces will be in a defensive posture which dictates far more Information System activity than were we in an offensive posture. Far more pressure is placed on the commanders in a defensive posture. He needs intelligence upon which to formulate his reaction to the offensive thrust and to move from the defense to an offensive posture. At the same time, he must preserve the logistical control over the resources needed to accomplish this goal dictate a real need for current, extremely high quality information as well as decision support.

The View of the Battle within the dimensions of space and time will be critical at the point of engagement as well as at the other echelons supporting the engagement. The thread of C2 is not just Army but Joint and ranges from the lowest element up through the Theater and to the NCA. In every instance, the Information Systems Resources will be the main and probably the only means to construct the View needed to sustain the actions and to coordinate and orchestrate the outcome to our maximum advantage. Any breakdown, as a result of incompatibility, or loss of service is a weak link in the chain of command and ultimately the support elements capability to provide the Combat Arms with the logistic support to sustain the action.

1.4. GO-TO-WAR

The Transition phase and the Go-to-War phase should be bonded throughout the whole system architecture. The Go-to-War phase can be described as the application of the resources developed and set in place in the first two phases. The winner is normally determined by the ability and will to sustain the action longer than the opposition.

2. OVERVIEW

Our present day Information Systems are not designed to support sustained high volumes of quality information on a real-time or close to real time basis. The systems have developed and evolved over time and reflect a processing and communications capability which is more in tune with the 1960's rather than the 1980's.

2.1. SHORTFALLS

The vast majority of the Information Systems resources which serve multiple users perform their processing in a batch mode. Some of the Information System do have some level of on-line inquiry and on-line services, but these are in the minority. The systems which have on-line, real-time or close to real time requirements need access to data resident on other systems and within the data bases of the other systems. The data is not universally available nor is it in a common form.

ISC/ISEC are responsible for a variety of systems classified as STAMIS or STAMMIS depending upon your definition and scope of application of the definition of a STAMIS. The vast majority of this group of STAMIS run on or under the ASIMS (VIABLE) Program. Included in this grouping are the major financial, personnel and logistics systems for the Army. STANFINS and SIDPERS are among the largest of the Army's STAMIS programs. These two programs more than any others interface and interact with just about every element in the Army. Logically, these programs should be able to automatically interact and share data at the data element levels, as should the logistics programs and the financial systems. Such is not the case. This same level of interaction should be true for the systems of the Reserve Components and the Active Component.

Data sharing and automatic interface should be a routine system function designed into the Hardware/Software/Transport suites. These systems have evolved from a manual, labor intensive form of input/output (I/O) ranging from mailing of cards and tape to some level of on-line transfer of batch files. In recent years personal computers (PC) level devices have been fielded to aid in the I/O functions. The centralized processing sites have been upgraded to include more modern peripheral sets (TAPE/DISK) and advanced processors with increased speed and primary memory capacities.

Concurrent with the increase in processing and storage capabilities, more and more of the labor intensive manual functions are being automated or have been at least semi-automated. The processing capacity of the backbone systems has never been able to keep pace with the demand for service. Consequently the delivery times for the jobs in the queue continue to stretch out and the users become more and more disenchanted with the decreasing levels of performance. The users optimistically continue to file new requirements for services based upon needs and the pressures of ever increasing efficiencies. Those requirements are put into the service and program queue and the service agents satisfy the requirements within the scope of their resources. Resources have been traditionally less than requirements and some services lag the original identification of requirements by as much as a decade.

Users are becoming more and more dissatisfied with the delivery of services from the service agent and they occasionally initiate programs of their own to solve the problems within their organic resources and external to the control system. This has been particularly true since the introduction of low cost PC level devices.

This situation has created a problem of significant proportions. It has been recognized by the Information Systems community, the DA Staff, the MACOMs, and the proponents alike for at least the last five or six years. The Information Systems response to this urgent need for a control mechanism to deal with the exploding problems of information was the formation of a study group from which evolved the ISC and DISC4.

These problems, which still exist in today's STAMIS environment, are extensive and pervasive. The bureaucratic inertia of the present organization which must be overcome in order to implement even the simplest changes is staggering. Therefore, some of the simple but effective changes which normally could have been implemented have not. DSI believes that the tools used in the present method of management of change are inadequate.

2.2. GOAL

The goal of this paper then is to identify the key factors involved in technology insertion/transfer, to show the relationships between these factors, and to provide technology insertion/transfer implementation guidance that will enhance the implementation of controlled change in a rapid manner.

It is important to be reminded of the basic principles established in Task #2. These principles are the foundation upon which the proposed methodologies are based.

- <u>Coordination and cooperation</u> at all levels of the Information Systems Management process is both <u>desirable and critical</u> to the successful advancement of quality and quantity improvements of the services provided to the <u>end-user community.</u>

- Reporting systems developed for the management and audit of the operations, planning and engineering of the Information Mission Area (IMA) resources should employ the latest technology available to the managers and the automation process should result in more productivity at the action officer levels. The resultant productivity should be measurable and sustainable. The automation process should resolve repetitive reporting problems at the action officer level as opposed to creating new reporting requirements.

- The suggested methodologies must be implemented by the matrix personnel to the maximum extent feasible, and will <u>utilize, and institutionalize</u> to the maximum extent possible and practical, information available within the <u>public domain</u> and other <u>Government agencies.</u> Every attempt should be made to capitalize on work already done or in progress.

3. <u>FACTORS INVOLVED IN TECHNOLOGY INSERTION</u>

The components of the technology insertion issue include the technology itself, the management structure used to implement the technology insertion, the performance requirements of the applications, and last but not least is cost.

3.1. TECHNOLOGY

The technology itself is multifaceted in its advertised approach but it still boils down to the standard three components of hardware, software, and transport. The three previous tasks under this contract have addressed these individual issues in detail and in relation to each other. TASK #2 focused on communications or transfer and how ISC/ISEC could quickly improve the transfer acquisition process while conducting a testbed for the "All-Source Data Base" concept. TASK #1 and TASK #2 both presented observations on hardware and its performance. In some cases the combination of the three components resulted in component and system performances which are less than optimum. Task #1 analyzed the current predicament of software in the STAMIS environment. Task #3 attempted to pull these discussions together into an overview and evaluation of the considerations required prior to migration and distribution of applications.

3.1.1. HARDWARE

Hardware development continues at an explosive rate. Hardware capacity far exceeds the capability of either software or transfer and will probably continue to do so as far into the future as we can project. Mainframe CPU speed is pushing the laws of physics and chemistry. Where an absolute speed limit has apparently been reached, the use of parallel processing and distributed processing are being investigated as are new components such as gallium-arsenide, GaAs. In looking at the problem of migration of applications, processing power at the mainframe has not been a problem. The problem was that until recently there was not enough processing power available at the user level. The once ubiquitous dumb terminal is now being rapidly replaced with PCs. At the PC level there are many manufacturers today who produce inexpensive hardware that is readily available to the government. Much of this hardware has more than 5 MIPS capacity and it is still small enough to sit on a desktop.

Scanner resolution and efficiency are improving. Scanned documents are now capable of full page text editing and graphics editing in a variety of programs.

Printers, dot matrix and laser, are better products at a lower cost. Color laser printers are finally reaching the market. Monochrome laser printers with resolutions of 1200 dpi by 1000 dpi are becoming available.

In the systems integration arena, multi-vendor networks are rapidly improving their performance levels. At the same time the need for systems integrators is growing rapidly because of the complexities of set-up and a corresponding lack on technical knowledge in the user community. Even with those problems the operation of the network is being simplified.

Other new technology includes optical disks. There is both good and bad news concerning optical disks. First the good news; capacity is continuing to increase. The bad news is that there is still no standard operating system support for the optical disk and none in sight. In the realm of the magnetic media the situation is much more optimistic. 3.5" floppy disk capacity is now up to 50 MB and 5 1/4" hard disks have broken the 1 GIGA BYTE barrier. Magnetic media is capable of 200 to 400 percent more storage than is currently available when devices with present technology are fielded in the next 12 to 24 months. Price per MB of storage is continuing to drop rapidly. The next high capacity hard disk may be in the 2" to 2.5" diameter range with the most likely market being in the portable computers. The message is clear that the intermediate future of magnetic media is much better than that of optical. This kind capacity portends an end to the debate about which operating system should the Army require as a standard. In fact, this kind of disk capacity almost makes this debate a non-issue. The user has no requirement or need to know that he may be running Unix with one application and DOS or OS/2 or XYZ operating system with another application. The user simply inserts the desired disk in the drive and boots the system. Plug and play, to use a currently popular phrase.

3.1.2. SOFTWARE

Numerous efforts at the micro/mini computer level are underway to produce more object oriented programming and to hide the complexities of the system from the user. The shift is away from forcing the user to comply with the cryptic and often "unfriendly" environments of software today and to develop software that conforms to the needs of the user. The software is being developed to work the way the user does and to present a more logical or intuitive interface with the user. The use of graphical interfaces will be the dominate interface in the near future. Other tools which will aid in the development of better user interfaces are embedded Artificial Intelligence (AI) and Decision Support System (DSS).

The potential volume of I/O continues to be a problem, albeit a decreasing problem. The judicious use of AI, DSS, and Executive Information Systems (EIS) tools should go a long way toward eliminating this as an issue. Voluminous printouts and reports are the norm in many places but the true question is "Who really reads all of information in those printouts and reports?" or "If someone actually has the time to read these volumes of information, then just how effectively are they applying their time and talents to their jobs?".

EISs are beginning to replace DSSs in some commercial situations. There are some leaders in private industry who believe that DSS is passe. That may be true in industry but the military need for a DSS tool will remain strong and separate from EIS. In a combat situation or in a critical resource management situation, decisions are DEMANDED thus the lasting requirement for DSS in the military. EIS is similar to DSS in that it extracts its data from the same types of sources, processes that data into information, and presents it to the manager/leader for his use as desired. No decisions are necessarily required in this case. The manager/leader may simply use that information to monitor the pulse of his organization, to pinpoint management areas which are out of tolerance, or to serve as fact sheets or travel books which can be taken on trips to visit subordinate units. The exact implementation of an EIS is only limited by the imagination of the developer and the user. Therefore EIS is currently being sold as a concept, a "management tool" for top management first and then it is then being pushed down to midlevel management, in some cases to the equivalent of the action officer level.

EIS is being sold as a concept because it has to be tailor made for the company and the executive(s) that are going to be using it. EIS intends to give the executive or in the Army's case, the commander, and those who work for him/her just enough information at the right time to help them make decisions or information to monitor the efficiency of the operation of their organization. There are some advantages to the use of an EIS. It can be tailored to the leadership/management style of the executives/commanders. It can also be used for information only purposes not requiring a decision. DSS tools used by the military are intended to require that the commander or staff officer make a decision based upon the data/information analyzed by the DSS. While some of the techniques used by DSS and EIS are similar, the intended purpose or goal of each system is sufficiently different as to prevent the free interchange of these tools. Use of an EIS may help reduce the reluctance some mid and senior level managers have in using a PC. The feeling that the use of a PC is somehow degrading to their decision making ability or that they are simply for secretaries may be lessened by the proper utilization of an EIS.

On the PC platform, the once glaring differences between Unix and DOS are fading away as an issue as OS/2 begins to mature. Other than the historical background differences between Unix and OS/2 the choice of which operating system to use or to support will soon be an issue of major concern only to developers and not so much so for the users or the integrators. Growing numbers of vertical and horizontal applications for each system are being written as well as some applications which will run on either system. The movement toward the use of a graphical interface for the user, X Window System for Unix and Presentation Manager for OS/2, and the use by both systems of Application Programs Interfaces (API) will effectively eliminate many concerns the user might have about using one or the other of these systems. The last significant differences exist between the Intel 80x86 world and the Motorola 680x0 world but even this gap is being closed.

3.1.3. TRANSFER

Communications speeds over voice circuits have reached at least a temporary peak at 19,200 BPS and prices have begun to drop. Communications over conditioned lines or special dedicated lines continues to increase in speed and the use of added intelligence. T3 capabilities are now beginning to show up in larger businesses. Communications with mainframes, especially in the IBM domain, is improving.

The bottom line is that sufficient compute power, communications capabilities, and intelligent software tools exist in the DOS, Mac, and Unix environments to support application migration and distribution down to most users levels today.

3.2. MANAGEMENT STRUCTURE

The basic management structure needed to support an effort of this scale currently exists within the ISC/ISEC community. However, there should be one agency, with the technical wherewithal, positioned to monitor and review the efforts of the proponents and the Project Management personnel in the migration work on the selected STAMIS. This technical agency needs to be in place as the honest broker in the selection and proper use of appropriate technology for insertion into the STAMIS. Standard project management techniques apply in this case after the project has been approved for selection and migration by this technical agency in coordination with the plans and operations elements in the ISC/ISEC headquarters.

3.3. PERFORMANCE REQUIREMENTS

The selection of the application must be made using the criteria proposed in Tasks 1, 2, and 3. In this case, it is wisest to first pick those applications which support Go-to-War missions as well as those which will produce the biggest bang for the buck in the redesign. In the latter category, it is generally those with the poorest performance followed by those with the most limited capabilities.

After a review of the criteria discussed in task 3 the following questions and observations related to application performance are worth repeating: " What applications should be selected for migration? What criteria should be employed in the selection process? Where will the processing actually be done after migration is completed? The analysis which is be conducted must include a look at factors such as priority for migration, how migration will effect system integration, what standards apply to migration of the application (data element, transfer protocols, etc), what efforts toward Modernization/Redesign are currently in place or on-going which will impact the migration, and what resource management controls and coordination are required?

Unfortunately for the Army and the users of the systems in place today, all existing applications need to be improved. Not all require extensive rewriting or redesign, some can get by with minor modification or improvements in the methods with which they interface other applications. By using the priority scheme discussed earlier which is first look at go-to-war then go-to-work and within these categories look at them from oldest to newest. The Go-To-War applications would then get the first look. Incidentally, it appears that they are also among the oldest of the existing applications and therefore stand to gain the most from an infusion of technology.

After the Go-To-War applications were reviewed the Go-To-Work applications would need a similar analysis. In as much as they are the "work horses" of applications the potential benefits from their modernization are tremendous. Productivity gains here can't be measured in exactly the same way they are measured in industry but they can be measured in terms that are important to the Army. Those terms are (1) time and (2) administrative efficiency. By increasing administrative efficiency you can decrease the time needed to perform this part of the mission. That time, the Army's most important asset next to the soldier himself, can then be devoted to training. This lack of training time because of administrative burdens is the most critical issue currently facing the Reserve Component (RC) which is more than 50 percent of our total force.

The AC faces the same problem but on more of a daily basis and from a slightly different point of view. AC forces simply have more time available for training than do the RC. Most of the routine administrative work in the sustaining base is performed by civilian employees of the Army. If the civilian employees perform their work properly then the AC soldiers will have the resources (Class I thru X, real estate, and information) to perform realistic training missions or simulations. The reality of the current situation is that the Army is continuously forced to ask these employees to do more and more work with less and less resources. Simply put, the work load has increased but the budget has either remained the same or has decreased. Political factors are the driving forces here and those forces are local as well as national and international. There is no projected relief in sight. Therefore we must work smarter and more efficiently with what we have."

Therefore it is important that a clear and concise description must be developed about the form and function of the target application after it has undergone redesign and rewrite to accommodate technology insertion. A Migration Plan must be developed which evaluates existing technology for use in the rewrite or technology insertion effort. There are a large variety of technological tools available for incorporation into applications. Where their use is appropriate the tool should be identified for possible use. Possible use is emphasized because care must be exercised to guarantee the selective use of these tools and only incorporate those where there is an appropriate need. The use of a tool simply because it is there is not in the best interest of anyone concerned and must be discouraged. For example, there are some applications which may be best suited to remain in the batch mode of operation. The determination about whether to leave them in batch or to what ever mode they are operating in must be made early in the development of the Migration Plan.

There is another category of products which have tremendous potential in this area. The category is bridges, software bridges. Successful bridge development extends product life cycles. Its follow-on-processor design ensures that it utilizes mission-developed data, rather than bending mission requirements to get data. A critical design consideration is the assurance that all applications offer interface boundaries. Regardless of implementation language constraints and application structure, software facilities like bridges can utilize effectively these interface points.

Still another category is prototyping. Prototyping using 4GL, screen generators and DBMS systems offers opportunities to extend life cycles and to reduce costs. Furthermore, AR 25-5 recommends that prototypes be used for problem definition, evaluation, testing, and verification and validation of proposed solutions.

Prototype development can dramatically decrease, if not obviate, the time necessary to develop and approve preliminary documents in the early design stages. The <u>most</u>

compelling reason for prototypes, however, is to ensure the correctness and validity of results gained by using modern DBMS and 4GL tools to discover bugs early.

Use of prototyping to test concept and the applications performance is an essential requirement. Structured prototyping is the recommended option for the majority of the work in this area although rapid prototyping certainly may the a useful technique in some cases. Quality Assurance (QA) is also an integral part software development, testing, and acceptance.

Trade-off analysis will have to be conducted during the design phase. To prevent to use of an application before its is ready requires that QA verifies design by using software metrics.

4. RELATIONSHIPS BETWEEN THE FACTORS

As was previously stated in paragraph 3 the major factors involved in technology insertion/transfer issues are technology itself, management, application performance, and cost. The relationships exist between the management, the application performance, and the cost. They are all impacted by the technology.

4.1. PROJECT MANAGEMENT

Project Management is critical to the success of the more complex of the migration efforts. One manager and not many will accelerate the migration and distribution effort. The idea is to use the minimum number of personnel but give them the most modern and efficient management tools available to do the migration work. Accordingly the Project Management Office should also use those same kind of modern tools to evaluate the progress of the redesign/rewrite effort.

4.2. APPLICATION PERFORMANCE

The use of software quality metrics may be the only effective way to measure the performance of either existing software or software under development. Normally the functional proponent has trouble articulating a reasonable or measurable performance standard. By helping to educate the proponent a little bit we may then be able to jointly specify performance.

In the course of events as the software design is being refined trade-off analysis must be conducted. Trade-off analysis is important to insure that the applied technology produces the expected results and that the performance can be evaluated in terms of a measurable quality metric

One of the major goals is that the software has to be optimized. How is this done? Has the software been optimized to perform on only one platform or across multiple platforms. Can software really be optimized across multiple platforms or only for one? What considerations are involved in this decision? Does processing occur as close to the source as possible? Are only transactions transferred? These are the kinds of questions those involved in the technology insertion and migration process must be asking.

The 3 tier architecture has to come into question when performance is being discussed. There are occasions when direct contact between the originator of a request and where the data base resides. If he has to go through multiple layers of common processing it will probably defeat performance requirements. Therefore we should tune the architecture to satisfy the users requirements. The requirements will suggest the kind of architecture but it may have and it may be less than 3 tiers.

4.3. COSTS

The decision to insert only a little technology in the migration can speed up the development effort thus saving funds but at a another cost of having less capability. Conversely, the insertion of too much technology will produce a risky product which could be difficult to maintain and to debug. The balance is a reasonable amount of technology at a reasonable cost (in funds and time) given the environment in which the application will ultimately operate. This balance should be addressed in the Migration Plan before the actual work begins.

5. IMPLEMENTATION GUIDANCE FOR TECHNOLOGY INSERTION

The establishment of a responsible office/agency to oversee the actions involved with the technology insertion and migration issue is the most important step in this process.

Project Management should be constructed with a view toward institutionalizing the Cooperation and Coordination scheme. People, particularly systems oriented, technically skilled people are in short supply. No single agent within the Information Systems Management structure has an excess of technically competent people. This alone should dictate the necessity to share the output of the higher skilled people on an Army wide basis. Who does it better is really not relevant. There are sufficient shortfalls in all areas, so much so that the logic behind the Cooperation and Coordination scheme should be self evident, and preclude diversions which have TURF as their foundation.

The selection, redesign, fielding, management, operation and control of the migrated systems which support Information Management is a shared responsibility between military personnel, Department of the Army Civilians, and the supporting contractors. NO one group has the capability without the support and commitment of the others to make the system(s), The Best They Can and Should Be.

There are many factors, particularly those dealing with forced reductions in resources, and lingering mutual distrust as a result of the handling of the Vietnam War which tend to skew the focus of one group or the other away from the principal goal which is national defense. National defense is a responsibility of every American regardless of their position relative to the actual performance of the national defense functions. Collectively we must come to grips with the reality of the potential negative impact of divided focus. The lack of a strong central focus causes inefficiencies and reduces the national capacity to preserve our position as the preeminent bastion of freedom.

The BOTTOM LINE on the Status and Capability of the Army Information Systems Resources are their ability to support the Go-to-War functions and to sustain our forces at a higher level for longer than an opponent. While it is nice to have a system in place which will provide the Commander with a "close out the end of year budget" on time, you can't point the balanced budget at an enemy who is intent on changing our way of life and expect a positive outcome. Neither can the shortfalls be resolved with study upon study by every conceivable level of the Army Hierarchy.

6. CONCLUSIONS

Army leadership needs to be convinced of the merits of taking immediate action to implement the redesign and rewrite of STAMIS and the concurrent insertion of appropriate or reasonable technology.

Funds needs to be identified for this purpose. Existing funds need protection from been diverted or siphoned off i.e.. becoming "bill payers" for other projects.

Standards are important but need to be of a looser framework than before while sights must be aimed at specific target levels of performance. Standards should guide direction and not stifle innovation. Traditionally, we have attempted to trade-off the opposing goals of modernization and standardization. By initially separating these goals, we find if we use selected modernization techniques such as Software Bridges to solve the mission requirements then standards do not have to be totally sacrificed but may instead be facilitated. There are some actions underway to automate the standardization of data elements process but the process still seems devoid of any AI tools or techniques. The use of AI would appear to offer a speed up of the effort.

Big bang for the buck pilot projects need to be identified and completed quickly (in weeks and months, not in months and years). Effective action is needed to increase the command's credibility in the users eyes and to strengthen the command's position during the PPBES process.

All of the tools are in place to make major strides forward in the migration of applications, we only need to stop visiting the issue and to take the necessary actions to implement them.

The user's needs and requirements are the sole reason for the existence of the ISC community. It is we who must change to meet the users expectations and not the users to meet ours.

If we complain about the lack of quality in the Information Systems we operate for the users it is because others, just like us, failed to take the necessary action to improve the systems when they had the chance to do so. Today, it is our chance to take that action.

7. RECOMMENDATIONS

That AIRMICS be designated as the "Technical Review and Transfer Agent" for ISC/ISEC. In this role, AIRMICS will be the technical overseer of Technology Insertion/Transfer and Migration projects in addition to their current missions.

That a limited scope "All-Source Data Base" as described in Task #2 be implemented as a pilot or proof of process project.

That ARPMIS be selected as the lead application for Technology Insertion and Migration testing.

That some level of performance standards be implemented to control development efforts during migration. As a subordinate to performance standards, a level of Standard

Query, which may or may not be limited to ANSI SQL, and a level of intelligence be included in all STAMIS related to the needs of the commander of deployed and deployable forces.

That functional proponents be actively involved with the project and if necessary that they be taught how to express their functional performance requirements in terms that are both reasonable and measurable.

That a Migration Plan be developed/approved by AIRMICS as a first step in the migration process after ISC/ISEC commits to the concept of selection and rewrite/redesign/migration of a STAMIS applications.

That Project Management be utilized to implement the Migration Plan and that the Project Management Office be structured to support the project's complexity and to maximize the use of personnel dedicated to the project until the project is completed.

WHITE PAPER

APPLIED RESEARCH AND TECHNICAL INSERTION AS A FUNCTION OF SYSTEMS INTEGRATION AND MODERNIZATION IN THE U.S. ARMY INFORMATION SYSTEMS RESOURCE

TASK #4

DRAFT ADDENDUM TO FINAL REPORT

by

Principal Investigator:
Gerard J. Dunleavy

Project Manager:
William R. Rainey

Project Staff:
Jean L. Dunleavy
Dennis J. Dunleavy

DUNLEAVY SYSTEMS, INC.
5770-72 Dunster Court
Alexandria, VA 22311

Presented to:
U.S. Army Institute for Research in Management
Information, Communications, and Computer Science
(AIRMICS)

13 December 1988

Contract No. DAKF11-88-C-0035
Project No. 030-88BG-0039

INTRODUCTION

This Addendum to TASK 4 is offered for the purpose of providing additional information and clarification, as requested, of the TASK 4 WHITE PAPER which was presented to AIRMICS on 2 December 1988.

The intent of this addendum is to offer further details on a recommended method of implementing the solutions suggested and discussed in TASKs 1, 2, 3, and 4 previously submitted by DSI. The process herein described is based upon three basis categories or views: system requirements, necessary characteristics, and the actions necessary for implementation.

REQUIREMENTS

The level of performance needed to achieve the results we are seeking is not currently available in the ISR, but if we adopt the proper implementation methodology, that performance is attainable. The first step in this methodology is to define the global or system requirements which in turn drive the means we will use to reach our goal. These requirements define the essential elements needed to create the baseline environment through which the higher performance levels are reached. The requirements which concern us are as follows:

* The requirement for interconnection and interoperability from the Echelons Below Corps (EBC) to the highest tier of the Information System Resource (ISR),
* the requirement for distributed processing and distributed databases,
* the requirement for data sharing,
* the requirement for distributed communications,
* the requirement for close to "real-time" performance for go-to-war functions,
* the requirement for continuity of operations (COOP),
* the requirements for system integrity and security,
* the requirement for software portability,
* the requirement for simplicity and commonality of training at all echelons of the system (tactical,

strategic, and sustaining base),

* the requirement for the system to dynamically reconfigure and reconstitute itself when necessary,

* and the requirement for a singular Army view of information needs, processing methodologies, and a delivery scheme.

CHARACTERISTICS

Before the requirements listed above can be addressed from either an engineering or a management point of view there must be recognition of several basis characteristics which the system must also possess. These characteristics are actually precursory to the requirements and they are as follows:

* the ability to automate the acquisition and storage of configuration data for all installed information systems,

* the ability to produce a system diagram and its critical control elements,

* the ability to automatically decompose the system view to its component parts,

* the ability to capture, analyze, and display system statistics and performance characteristics,

* the ability to decompose the system view down to the base, post, station or an individual user and to produce a graphic presentation of the user and his information processing needs and capabilities,

* the ability to perform intelligent analysis and produce graphic representation based on addition, subtraction, or modifications of system/subsystem factors,

* and the ability to articulate needs over time and in relationship to the threat scenarios (to handle the range and mix of the various situations which could exist as the nation moves from peace time to transition to war)

ACTIONS

The items below are those representative steps which need to be taken in order to implement the solutions which have been offered by DSI. The development of these steps has taken into consideration the requirements and characteristics listed above. These steps do not attempt to answer all of the requirements and characteristics as shown, but they do include those which allow the quickest implementation and the highest payoff for the minimum investment. The steps are presented in relative chronological order. A representative slice of this solution could easily be demonstrated with a proof of process system.

* Capture configuration data for all systems including a view of as installed and planned upgrades for hardware, software, and transport.

* Provide a utility to graphically display system and subsystems configuration. Make the utility available down to user level.

* Design a set of common support modules for use in the ISC community to include the DOIMs, Engineering, Plans and Operations. The key is the use of ONE common reporting and status program.

* Provide a common set of analysis and decision support tools to interact with IMA configuration data base. These tools could and should be used to do capacity planning, capacity measurement, modeling and simulation.

* Integrate analytical and decision support tool set with the configuration data base and make it available to the action officer level.

* Install total system configuration data responsibility within ISC. Configuration data is a responsibility of ISC. In the fulfillment of this responsibility the ARPMIS data base could be populated with the types of additional data needed to establish the ARPMIS application as the cornerstone of the basis environment needed to achieve the improved performances being sought. The coordination and cooperation of the proponent is essential to the success of this effort by ISC.

* Adopt a standard software development methodology.

* Prioritize STAMIS modernization and redesign scheme, with emphasis going to Go-to-War support and the interface between the tactical CSS , the strategic and the sustaining base.

* The development of major systems must be monitored to insure that a logical thread of commonality exists

between them. The development of RCAS in the Reserve Component and the modernization and redesign of major applications (STAMIS) in the Active Component is an example of an opportunity which will exist in the very near future to achieve this goal.

* Developments in other MACOMs, Services, DoD, and industry need to be monitored to track potential overlap of efforts. Additionally, technology developments need to be monitored and assessed for use or inclusion in the systems as a level of appropriate integration. Thus a summation of these actions could be as shown below if one were to do an applications overview

```
+------------+      +------------+      +------------+
|   ISMs     |      |  STAMIS    |      | TECHNOLOGY |
| Interface  |      | Interface  |      |  DATABASE  |
|    for     |      |    for     |      |    run     |
|Base, Post, |      |DOIMs,Engrs |      |    by      |
|and Station |      |Plns&Opns   |      |  AIRMICS   |
+------------+      +------------+      +------------+
```

CONCLUSIONS

The development of what might be called an adjunctive knowledge based system could address most of the requirements and characteristics listed above. This system could demonstrate a representative slice of the total system which must be developed if we are to increase the performance levels in existence today.